

Characteristics of the European beaver (*Castor fiber* L.) population in the Tuchola Forest

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The European Beaver Active Protection Program introduced in 1974 contributed to the development of many local beaver populations throughout Poland. The objective of this study was to characterize the European beaver population living in the Tuchola Forest. A total of 482 beaver sites were found in the investigated area comprising six forest divisions and the Tuchola Forest National Park. 85% of the animals live in dens, and only 15% in lodges. An average population density across the analyzed area is 1.13 animals per 100 ha. The vast majority of beaver sites are located in rivers, lakes and drainage ditches.

KEY WORDS: *Castor fiber* / population / habitat

The European beaver (*Castor fiber* L.) was a protected species in Poland already in the 10th century. Although the privilege of hunting for beavers was reserved for men with power and authority, beaver populations continued to dwindle throughout the ages. In the 18th century, the species was still found throughout the entire country, but in the first half of the 19th century, only few beaver sites remained due to excessive hunting [18]. After World War I, beavers survived only in the basins of the Niemen and Prypeć rivers. In 1928, the beaver population was estimated at 235 animals. The species received active protection under legislative acts (of 1919 and 1934), and by 1939, the beaver population increased to around 400 individuals [19]. In 1949, 26 beavers were purchased from Yoronozh (today, the Russian Federation) and resettled to the area of Biebrza and Oliwa. Beavers began to migrate to Poland from Lithuania and Belarus, yet their populations remained low at under several hundred animals, and beaver habitats were found only in north-eastern Poland. In 1974, Professor Wirgiliusz Żurowski of the Experimental Institute of the Polish Academy of Sciences in Popielno proposed the European Beaver Active Protection Program. As part of the program, several dozen beavers raised on the farm in Popielno as well as wild beavers from the Suwałki region were resettled to various Polish regions every year [18]. As a result of the program and

the assistance of the Polish Hunting Association, the beaver population increased to around 25 000 animals, and beavers are now found in many subpopulations throughout the country [7, 9, 11, 19].

The objective of this study was to characterize the European beaver (*Castor fiber*) population in the Tuchola Forest, to describe beaver sites, their density and distribution in various parts of the investigated area.

Materials and Methods

The Tuchola Forest, also known as the Tuchola Plain, is a sub-region of the Pomeranian Lakeland in the basin of the Brda and Wda rivers. It covers a section of the Polish Lowland with the east longitude of 17°30' to 18°35' and north latitude of 54° and 53°40' [15].

Data on the European beaver population in the Tuchola Forest were gathered in the second half of 2007. The data were released for the needs of this study by the forest divisions in Tuchola, Woziwoda, Osie, Zamrzenica, Rytel and Czernsk which report to the Regional Directorate of the State Forest Enterprise in Toruń. The relevant data were collected during field observations and local surveys performed by forest division employees.

The presence of beaver sites was determined based on visible and fresh traces of beaver activity (habitats, structures, lodges, feeding grounds, etc.). Beaver sites were described in view of the type of habitat, i.e. den or lodge, the presence of dams, and the type of watercourse or water body where the animals reside.

Results and Discussion

A general characterization of beaver sites in the Tuchola Forest is presented in Table 1.

The results of local surveys performed in 2007 by the forest divisions of Tuchola, Woziwoda, Rytel, Czernsk, Zamrzenica and Osie as well as the Tuchola Forest National Park point to the presence of 482 beaver sites in the investigated area (Table 1). Assuming that an average beaver family inhabiting a given site consists of 3.7 animals [18], the size of the beaver population across the studied area has been estimated at 1780 individuals. According to Kasperczyk [14], there were 21 beaver sites in the Tuchola Forest in 1987. The presence of beavers in the territory of the Tuchola Forest is most probably due to natural migration from the Gdańsk Province [1]. A comparison of the cited data and of the results of this study suggests that European beaver populations have grown substantially over the past two decades. In view of Table 1 data, dens account for 85% and lodges for 15% of all beaver sites reported in the analyzed area.

According to data gathered in the late 1980s, dens accounted for 51% of all beaver sites noted in Poland [18]. This study and the information supplied by forest divisions confirmed that dens are built more frequently than lodges. Nevertheless, dens have a much higher percentage share of beaver sites in the investigated territory. The above

Table 1 - Tabela 1
 Characteristics of beaver sites
 Charakterystyka stanowisk bobrowych

Forst division Nac leśnictwo	Number of sites Liczba stanowisk	Number of dens Liczba nor	Number of lodges Liczba zeremi	Number of dams Liczba tam
Tuchola	20	19	1	14
Woźiwoda	86	93	9	26
Rytył	29	32	5	17
Czersk	104	118	19	24
Zamrzenica	118	121	8	28
Osie	120	100	43	23
"Tuchola Forest" National Park	5	5	0	0
PN "Bory Tucholskie"				
Total - Razem	482	488	85	132

was also validated by the findings of Bereszyński and Homan [4] who studied beaver habitats in the Poznań area. A high share of dens in beaver sites is due to land topography. Water bodies and rivers have high banks made of cohesive soil which enable beavers to build dens stretching into the land [16]. The den entrance is always situated under water at a depth which never freezes up. The entrance opens onto a slanted corridor which leads upwards to the nest chamber. The above den configuration is possible when the bank extends 1.5-2 m above the upper edge of the entrance. The nest chamber is usually found 0.3-0.7 m above the upper edge of the den entrance to prevent flooding [6].

The average population density per 100 ha, with a division into forest divisions and the National Park territory, the total beaver population and population density across the entire investigated area are presented in Table 2.

As shown by Table 2, the highest beaver population density was noted in the forest division of Osie, followed by forest divisions of Woźiwoda, Czersk and Zamrzenica. The lowest density was reported in the Tuchola Forest National Park. The average population density throughout the investigated area was 1.13 animals per 100 ha. As noted by Aszyk and Kistowski [2], the average beaver density in the Pomeranian Province is 4.3 animals per km², i.e. more than 12 times less than in the region of Podlasie (52 animals/100 km²), and several times less than in the Provinces of Warmia and Mazury and Mazovia. Based on the data contained in Table 2, the following beaver population density was noted in each analyzed forest division: Tuchola - 53 animals/100 km², Woźiwoda - 119 animals/100 km², Rytył - 71 animals/100 km², Czersk - 107 animals/100 km², Zamrzenica - 76 animals/100 km², Osie - 272 animals/100 km², while the average density in the Tuchola Forest National Park was 43 beavers per 100

Table 2 - Tabela 2

Population density of the European beaver in the research area
Zagęszczenie bobra europejskiego na badanym terenie

Forest division Nadleśnictwo	Total land area Całkowita powierzchnia terenu (ha)	Estimated number of animals (animals) Szacunkowa liczba zwierząt (szt.)	Population density (animals/100 ha) Zagęszczenie (szt./100 ha)
Tuchola	15063.81	80	0.53
Wozivoda	14887.49	177	1.19
Rytel	17539.00	125	0.71
Czersk	14517.00	156	1.07
Zambrzeńca	20836.11	159	0.76
Osie	17137.00	466	2.72
"Tuchola Forest" National Park PN "Eory Tucholskie"	4613.05	20	0.43
Total - Razem	104593.46	1183	1.13

km². By comparison, various authors estimated beaver density in eastern Lithuania at 23 to 190 animals/100 km² [5, 17], and in Sweden and Latvia at 10 to 22 [10] and 50 animals [3], respectively.

The size of the habitat that can effectively sustain a beaver family is directly determined by environmental factors, such as favorable hydrological conditions, land topography and the availability of food [6]. The following parameters of the beavers' water habitat are also taken into account: water depth, flow rate and the width of a watercourse. According to various sources, the length of the watercourse section required to sustain a beaver population ranges from 6 to 50 km. The minimum habitat area of a single beaver family in swamps and stagnant water bodies is estimated at 10 ha [6, 8].

Maximum site density is determined by the availability of food, hydrological conditions and human pressure. According to Zurowski and Kasperczyk [20], site density ranges from 0.15 sites per km² in the Suwałki region to 0.20/km² in Sweden. The results of this study point to site density of 0.46/km² in the investigated area (Table 3).

Beavers have highly developed adaptive skills and they can live in diverse habitats. A typical beaver habitat consists of wooded river banks, lagoons, lakes with a relatively stable water level, streams and meadow communities [8], as confirmed by the results of this study (Table 4).

Table 4 data indicate that rivers are the preferred type of beaver habitats in the Tuchola Forest. In the investigated area, 212 sites were found on rivers, accounting for 57% of all sites, 83 sites were reported on lakes (23%), while 42 sites - in drainage ditches (12%). Other types of beaver sites (3%) were found on protected farmland and

Table 3 - Tabela 3Density of beaver sites in the research area
Zagęszczenie stanowisk na badanym terenie

Forest division Nadleśnictwo	Land area Powierzchnia terenu (km ²)	Number of sites (sites) Liczba stanowisk (szt.)	Density of sites (sites/km ²) Zagęszczenie stanowisk (szt./ km ²)
Tuchola	150.63	20	0.13
Woźniwoda	148.87	86	0.58
Rytele	175.39	29	0.16
Czersk	145.17	104	0.72
Zamrzenie	208.36	118	0.57
Osie	171.37	120	0.70
"Tuchola Forest"			
National Park	46.13	5	0.10
PN "Bory Tucholskie"			
Total - Razem	1045.92	482	0.46

Table 4 - Tabela 4Location of beaver sites (sites/%) in particular types of habitat
Lokalizacja stanowisk bobrowych (szt./%) w poszczególnych rodzajach środowisk

Forest division Nadleśnictwo	Habitat type - Rodzaj środowiska						
	rivers rzeki	lakes jeziora	drainage ditches rowy melioracyjne	swamps bagna	ponds stawy	channels kanały	other inne
Woźniwoda	54	16	9	1	1	5	-
Rytele	17	9	-	-	-	2	1
Tuchola	16	2	-	-	-	-	2
Czersk	57	26	15	2	1	-	3
Osie	68	25	18	3	2	-	4
"Tuchola Forest"							
National Park	-	5	-	-	-	-	-
PN "Bory Tucholskie"							
Total - Razem	212/57	83/23	42/12	6/2	4/1	7/2	10/3

private land. Channels were home to 7 sites (2%). Beavers were least likely to settle in swamps (6 sites, 2%) and ponds (4 sites, 1%).

According to Karbowski [13], the domestic *Castor fiber* L. population resides in the following habitat types: rivers (54%), lake banks (29%), drainage ditches (17%), peat excavation sites and mid-forest swamps. The above data are consistent with the findings of this study. According to a survey of beaver habitats in the Suwałki Lakeland carried out in 1984-1985, the animals were most likely to settle in lakes (49% of all

sites), rivers (38%), drainage ditches (5%) and other locations (8%) [20]. The distribution of beaver sites in the territory of 13 national parks was investigated by Brzuski and Kulczycka [6]. They noted that the majority of dens and lodges were found on rivers (79% and 62%, respectively), followed by channel banks (dens - 8%) and lakes (lodges - 14%). The highest beaver density in the Mazovian Province [12] was determined in large river basins (Vistula, Narew, Bug) and in areas with extensive watersheds (Zegrzyński Lagoon). Similarly to the Tuchola Forest, the largest clusters of beaver colonies in the Mazovian Province were found in the vicinity of major watercourses, while many swamps, damp areas, smaller rivers and drainage ditches have not yet been colonized by this species [12].

To conclude, the study investigating European beaver populations in the Tuchola Forest has revealed 482 beaver sites in the six analyzed forest divisions and in the Tuchola Forest National Park, indicating a total population of 1780 animals. 85% of beavers reside in dens and 15% in lodges. The highest density of beaver sites was determined in the forest division of Osie, while the lowest - in the Tuchola Forest National Park. The average beaver population density throughout the investigated area was 1.13 animals per 100 ha. The highest number of beaver sites was found on rivers (57%), lakes (23%) and drainage ditches (12%). The results of this study indicate that the European beaver population in the Tuchola Forest continues to grow. The development and distribution of beaver sites should be regularly monitored, in particular in locations marked by the highest population density.

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Charakterystyka populacji bobra europejskiego (*Castor fiber* L.) bytującej w Borach Tucholskich

Streszczenie

Pozytywnym efektem wprowadzonego w 1974 roku Programu Aktywnej Ochrony Bobra Europejskiego było powstanie na terenie całego kraju wielu lokalnych populacji tego gatunku. Celem pracy było scharakteryzowanie populacji bobra europejskiego bytującej na terenie Borów Tucholskich. Na obszarze 6 analizowanych nadleśnictw oraz na terenie Parku Narodowego „Bory Tucholskie” zlokalizowano łącznie 482 stanowiska bobrowe. Zwierzęta tam bytujące w 85% zamieszkują w norach, a tylko w 15% w żeremiach. Średnie zagęszczenie bobrów na całym badanym terenie wynosi 1,13 osobnika na 100 ha. Najwięcej stanowisk bobrowych zlokalizowanych jest nad rzekami i jeziorami oraz nad rowami melioracyjnymi.